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ABSTRACT

In order to teach anything, two fundamental questions must be asked and answered continually: What should be taught, and how should it be taught? The answer to the second question is highly dependent on the answer to the first, but the present answer to the first question is inadequate and inappropriate to today's communication tools. Language must first be viewed as an interactive process in which content must be placed in context. Teachers alone cannot teach content without the appropriate context, but educational technology, particularly new interactive video systems, can do so. Unfortunately, the common approach to using such technological innovations is to adapt them to old methods rather than developing their unique characteristics and exploiting their potential for advancement. Possible new techniques include use of visually obvious segments from broadcast television, cable broadcasts into which quizzes and immediate feedback are integrated, and interactive videodisks containing games, entertaining feature films, and creative movie-making. (MSE)

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LANGUAGE AS AN INTERACTIVE PROCESS

James R. Nord

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LANGUAGE AS AN INTERACTIVE PROCESS

James R. Nord

Introduction

In order to teach anything, two fundamental questions must be continually asked and answered: (1) What should be taught? and (2) How should it be taught? This has been true of teachers teaching in a classroom, it is even more true for "teachers" who teach vicariously through textbook writing, instructional materials design, instructional film production or instructional computer programming efforts, since the results of their efforts affect a far greater number of students. For example, one foreign language teaching video program, *Follow Me* is said to by seen by as many as 10 million Chinese alone.[1]

For most ordinary foreign language teachers teaching in the classroom, the answer to the first question often seems simple. Foreign language teachers teach the foreign language. These type of teachers therefore tend to seek answers to the second question, "How should language be taught?" assuming they already known the answer to the first. Most "teachers" who teach vicariously also seem to focus their attention on the second question, and are continually asking "How can we use these new educational technologies like computers and video disks to teach language better?" They apparently assume they already have the answer to the first question.

This paper will argue that the answer to the second question is highly dependent upon the answer to the first question. It will also argue that

the present answer to the first question is woofully inadequate, indeed inappropriate to the communications tools available today. The focus of this paper is therefore an attempt to address the first question "What should we teach?" in as comprehensive a manner as possible. This means that we must begin again at the beginning and ask and answer in a sufficiently adequate manner, "What is Language?"

Language as an Interactive Process

What is language? For most people language can remain rather simple. It is the words we use,. It is a system of grammar and vocabulary. It is a means by which people communicate their thoughts. We all use language so much in our everyday lives that we may be like fish who don't understand water because they are totally immersed in it. For professionals in the field of foreign language teaching more understanding would seem required. For teachers creating vicarious teaching material which will affect vast numbers of students, one would think that this question would evoke a carefully thought out and scientifically valid answer. But there is little deviation from this widely held position that "language" is that communications device used "between" people. When an expression like "language as an interactive process" is mentioned, it is widely assumed by professional and layman alike that it means something like "a conversation" between two people.

This is definitely NOT the interpretation in this paper.

This paper views language as a phenomenon which takes place within the human brain. The interactive process between people is seen not as language, but as a form of social language USAGE, as an indication of language within the participants' brains. This paper sees language as an interactive process between signal and meaning within the brain. While this view of language is not necessarily widely held, it is not a new view of language.

This view of language as an interactive process within the brain was expressed over 100 years ago, and although it was given a good deal of

publicity, it has not been fully accepted by either the general public or the scientific community. The view was expressed as a personal experience. Stories about it vary. But it goes something like this.

> Annie Sullivan began to move the handle of the pump up and down. Soon a steady stream of water came pouring out of its spout. Now she took Helen's hand and held it under the cool flow. W-A-T-E-R, she spelled into Helen's wet hand. At first, Helen pulled away. But then, suddenly, she stopped. A new light seemed to come to her face. Annie saw the look. W-A-T-E-R, she spelled again quickly. W-A-T-E-R! W-A-T . . . . Helen began to spell back. And with each movement her face grew brighter. For suddenly she knew! The shapes that the stranger was making with her fingers did have a meaning! Everything had a name. Everything in the whole world had a name! And she could learn them all.[2]

The story is about Helen Keller and her first encounter with language. It was sign language not oral language, because Helen was deaf. It was sign language not written language because Helen was blind. Helen Keller's first language was sign language but it was not a language for her until it interacted with meaning in her brain. Helen had been like a fish out of water. Annie Sullivan had been moving her fingers in the form of letters for weeks, but there was no language until the sign in her hand connected through the brain with the water in her hand. It was the interaction of the sign and the meaning in the brain that made language for Helen. This language, this interaction between signs and meanings in the brain opened a whole new world up for Helen Keller. The insight made a hundred years ago, can open up a whole new world of language study and training today, if we take it seriously.

But it is not easy to see language from this point of view. For layman and professional alike language seems to be something "out there". And any interaction is also seen as "out there." As Piaget has pointed out,

> Once a concept is constructed, it is immediately externalized so that it appears to the subject as a perceptually given property of the object and independent of the subject's own mental activity.[3]

It may be quite natural to see language as something "out there", because that is the natural learning process. If we didn't do this we would be swamped by constant change. When we look at a corner in the room, it appears to remain stable, to remain the same, no matter where we see it from. Even though the angles change in our perception as we move around the room, we "project" the angles as always remaining at 90 degrees "out there." This is our way of "stabilizing" an otherwise constantly changing perceptual scenery. Anyone can test this thesis by looking at some object and jiggling their eyeball with their finger. By this same stabilizing "projection" process, we also learned that the world was flat and that the sun rotated around the earth. It is all just common sense. This "common sense" is so strong, that it is often hard to change. It is part of the "knowing" process.

Philosphical Background[4]

What we are really dealing with is epistomology or the nature of "knowing". The basic problem is in understanding the respective roles of the "knower" and the "thing known" in the act of knowledge. These roles have been a matter of philosophical controversy for some time, and the subconscious allegiance one has to a particular philosophy can bias the way one looks at any knowledge gathering process such as foreign language learning. The two basic schools of thought are the rationalists and the empiricists.

To state it briefly and somewhat crudely, the rationalists believe in the inherent capacity of human intellect to apprehend the world. This implies that human intellect is in some ways preadapted to the world. In a sense, the structure of the world has been incorporated into the structure

of the mind, and this enables human beings to adopt a certain approach toward reality without first learning it. Kant for example, believes that there is the existence of "*a priori* categories of understanding" such as those of cause and effect. These categories direct the person in such a way that he will automatically think of things in terms of causality, and will not need to learn this orientation. Chomsky posits a LAD or Language Acquisition Device in humans. He believes that humans have an inherent capacity to acquire a language without conscious learning. For him, however, language is still that external signal system which passes between people, meaning is something that language then connects to but language itself does not have meaning. The language and the meaningful connections are seen as a species specific device which allows humans to "acquire" language and meaning "naturally." The rationalist, therefore, accentuates the role of the "knower" at the expense of the object known in the knowledge situation. The knower comes to the knowledge situation with his *a priori* structures which determine what will be known. External reality therefore plays a lesser part in knowledge since the knower imposes on it certain structures of his own. The role of the teacher in these cases is basically as a provider of the knowledge. In foreign language teaching, this is the native speakers' role, to provide the language model for the student to acquire, through normal maturation and development processes.

Empiricists, on the other hand, stress the role of experience in the knower-known relationship. We gain knowledge and learn modes of reasoning by experiencing the world through our senses. We do not create or impose our own structures of thought on external reality. Objects exist by themselves and the knower merely produces a copy of them, rather as a mirror reflects the properties of objects by means of images. The role of the knower is therefore reduced since he merely discovers, by his use of the senses, what is outside himself. In psychology, empiricism has been very popular. Behavioral psychology is an excellent example. According to this view, a person is a *tabula rasa*, a blank slate, on which impressions of the

environment are stamped. The individual's contribution to the known-known situation is viewed as passive, and the importance of the environment is emphasized. External reality, therefore, plays a predominant part in the growth of knowledge. According to empiricists, knowledge is learned through the senses. Rationalists say that knowledge is acquired through maturation. The empiricists position is widely held by the teachers and the public educational systems. Again, most empirically oriented linguists see language as something "out there".

Piaget, on the other hand, attempts to provide a synthesis of these two opposing points of view by proposing what he calls an "interaction theory". This theory stresses the interrelationship between the knower and the known in the act of discovering reality with each element making a more or less equal contribution, and each influencing the other in an interactive manner. Piaget thus acknowledges the importance of the environment which undoubtedly determines the development of thought to a certain extent. Obviously the type of experience he acquires and the situation to which he is exposed will channel the child's mental performance. But he points out that they will not determine development completely because the child at no instance comes to a situation with a *tabula rasa.* Everyone comes to an environmental experience with a mental structure, or accumulation of past experiences in the form of schemes, and these will influence his apprehension of reality. No one comes to a second language situation, without a scheme of his first language. People of different ages have different conceptual structures and hence will approach language learning with individual differences. All children have some conceptual "meanings" in their mind when they first encounter and apprehend the signs and signals people have called "language". Helen Keller knew what water was before she learned the word in sign language.

Piaget applies the interactive theory of knowledge acquisition in general. He distinquished two complementary aspects of the interactive process: assimilation and accommodation. A classic story illustrates how these com-

plementary twins operate in a child learning his first language.

Child:	Look, Daddy, what's that flying up there?
Father:	Oh, that's a bird.
Child:	Oh look, there's another bird.
Father:	No, that's a butterfly.

One could look at this as if it were a "conversation" between two people. In almost all of the discussion regarding education, interaction is seen as this process between two people, the teacher and the student usually. In "interactive" video disks, the computer becomes a teacher substitute. In foreign language teaching, we sometimes have "pair work" and the interaction is seen as between two students. For many, interaction seems synonomous with "conversation". Rivers in talking about interaction refers to the twin skills of reception and production, listening and speaking, i.e. conversation between people.[5]

I would like to suggest that there is another way of looking at interaction particularly as it applies to language development. In the "conversation" just mentioned, between a father and his child consider what happens "inside" the brain. The child, seeing an object he has conceptalized as a stable concept, asks for an address label so that he can file this in his memory for easier retrieval later. The father gives him the label, "bird". He "assimilates" this label into the concept and forms a permanent "interactive" resonance between the two. We could refer to this as "symbolic" learning. The child then sees another example of what he considers the same "concept", or now "symbol" so he expresses this, "Oh, look, there's another bird." The father provides "another label" which contradicts the first impression. The child must now "accommodate" by altering his conceptual structure to fit the new information received.

The "interaction" being referred to here is an interaction of information. The "conversation" is a coupling of two information systems. Looking at these two people as "information systems" we can infer the

following: There is an "interaction" "within the father" (system 1), "within the child" (system 2) and "between" the systems. Going back to the relationship of the "knower" and "the known", it is critical to recognize that "the known" is not the sound signal, the words, it is the relationship between the label and the concept, it is the interactive relationship between two "knowns". The father provides only one of these knowns, the other is either seen directly or recalled from past experience. The child, in forming this "symbol" uses information from everywhere, from what he sees, from what he feels, from what he remembers, from everywhere, not just from his father. In his "conversation" with his father, the external interaction had much less importance as far as language learning is concerned than the internal interaction which took place in the brain.

Language: an internal interaction process

To propose that we look at language as an internal interactive process is not new, but it is unusual. It is difficult for most people to accept this position at first. It creates cognitive dissonance. It is foreign to most people's view of language as communication and interaction as something which happens between people. But is it really so strange? Consider our approach to communications in other areas.

Television is considered a means of communications, just as language is considered a means of communications. But consider what we mean when we refer to TV. TV is a system. It consists of an input device, the camera, a transmission channel, the airwaves or cable, and an output device, the TV receiver. The camera focuses upon a particular scene and from that scene, it detects a multidimensional set of data. It detects form on the basis of different light intensities and different color spectrums falling on very tiny sensors. This multidimensional scene, which we take in as a whole, is known as a gestalt, or analog. In humans, analog messages are received through our senses and processed largely through the right hemisphere

of the brain. In TV, analog messages are picked up through a camera lens and then processed in that camera.

In television systems this multidimensional analog, is converted into a one dimensional electromagnetic code by the camera and then transmitted, either through cables or over the airwaves. In humans, the analog is converted to a one dimensional digital code which operates primarily in the left hemisphere and is transmitted through the airwaves by manipulation of the voice box. In TV systems the one dimensional electromagnetic code is received by individual TV receivers through an antenna or cable system, and the receiver "regenerates" the multidimensional analog picked up by the camera's sensors. In some of our modern long distance television systems, such as those used to send data from space, interferences can cause distortion in the one dimensional transmission signal during its long voyage through space. This tends to cause distortion in the "regeneration" process. To help counteract this deteriation of the quality of the reception, modern computers built into the TV receivers can "enhance a picture" to "regenerate it" even though some of the transmission signal was lost or distorted. Human receivers of one dimensional digital code systems commonly referred to as "language" "regenerate" meaning in a similar manner.

Now when we talk about TV, we seldom if ever consider the electromagnetic waves passing through the atmosphere as being "the TV". If there were no receiver around, or if it were not turned on or tuned in, we would not even know that the electromagnetic waves were passing by us. Everyday we walk down the street bombarded by electromagnetic waves. If we have a radio on us, and if we turn it on, and if we tune in to the proper frequency, we realize that these waves exist. Otherwise we ignore them. We certainly do not call them radio. Radio, is the converter. Television is the receiver. Language is the tuner, the regenerator inside all of us.

The problem with this position is classic. What goes on inside the head is not observable. It is a black box. For many years, "thinking" was considered beyond the realm of science. In Newtonian Science, only the

observables can be considered scientific evidence. As a consequence, most earlier "scientific" approaches to language have been focused on the observable part of language, the signals which go between people. Interactions have been considered as the "observable" interactions between people. This tendency on the part of professionals as well as laymen to consider language as a phenomenon which takes place "out there" is quite wide spread and strongly entrenched.

Recent attempts to "reform" language teaching and make it more "scientific" are often cited as evidence that change is taking place within the foreign language teaching profession. Many refer to Chomsky and his attack on behavioralism.[6] Many seem to show more concern for "meaning" by referring to "situational/notational/or functional syllabii"[7] There are more and more people talking about language acquisition as if it were a cognitive, rather than a behavioral phenomenon.[8] Chomsky tried to make a distinction between *competence* (the speaker-hearer's knowledge of his language, and *performance* (the actual use of language in a concrete situations),[9] yet, almost all of the literature on "communicative competence" refers to "communicative performance" to "speech acts".[10] Those who supposedly espouse a cognitive view of language acquisition still see language itself through the eyes of a behaviorists . . . as something "out there." As Postovsky pointed out,

> . . . some proponents of the cognitive theory of language acquisition, while rejecting the mechanistic approach to language teaching, still adhere to the behavioristic view of language as a phenomenon. To them, language is still "talk." It may be defined as "communicative competence and performance," but conceptually it is exactly the same as *verbal behavior*. It logically follows this essential behavioristic premise that *language learning* is equivalent to learning to talk.[11]

Although the importance of language usage for social cohesion in man

cannot be overestimated, and its dependence on interaction between individuals is established, the communicative function of language can also be misleading. It can divert our attention from the real concern. As Lenneberg put it.

> An overemphasis on the communicative aspects engenders the notion that language has been purposely devised, like a tool, to serve as a vehicle for the transfer of information. This attitude glosses over the real problems: what is the *nature* of the sender-receiver, and how is the range of messages limited or even determined by the structure and function of the devices that do the communicating, i.e. the brains involved? [12]

A classic story from the Sufi, illustrates the situation all too clearly.

> One night a man saw Nasrudin searching for something on the ground near a lamppost. "What have you lost, Mulla? he asked.
>
> "My key," said the Mulla.
>
> So the man went down on his knees too, and they both looked for it.
>
> After a time, the other man asked: "Where exactly did you drop it?"
>
> "In my house, in the kitchen."
>
> "Then why are you looking out here?"
>
> "There is more light out here than inside my house."

The solution is not to look where there is light, to observe the obvious, but to determine first WHERE TO LOOK and then to bring light to the focus of concern, to make observable, the presently unobservable, to make explicit what has been implicit. The solution is to shift one's point of view, to look at language from a different perspective to change the theory of language we use when we consider language teaching.

Developing a new Scientific Theory of Language

This paper will attempt to move toward a new theory of language in which language is considered as an interactive process which takes place only in the brain. It will attempt to present language from a scientific point of view which is highly compatible with the latest educational technologies, particularly those of an audio/visual/computer nature such as the interactive video disk systems. This approach will temporarily us move away from a definition of language which is easily observable to a definition of language which is not directly observable. This paper therefore considers a new theory of language which may not be readily apparent.

Theory has been a badly abused word. It has been misused so much that it is often today considered to be the antonym for practice. Yet practice could not take place without a theory. In referring back to the original Greek meaning, we find that the word theory comes from *theoros*, "spectator", from *theasthai*, "to observe, to watch, to look at", and from *thea*, "a viewing". The word theater is derived from the same origin. In this paper, theory is being used in this original sense, simply as a pointing or focusing device. A theory is thus very practical. The problem is that most teachers have been looking at language as if it were something "out there". That has been their theory. It is time, I believe to change that theory. It is time to make language study more scientific by changing its basic theory of language to one which takes place in the head rather than "out there."

Making visible the invisible

This approach is uncomfortable for most people because if moves language from an observable phenomenon to one which is invisible. Fire, water, earth and wind were consider the basic elements of nature for many years because they were observable. But they were replaced by an atomic theory in which the basic building block, the basic element of nature, the

atom was not directly observable. At first, many considered this to be a giant step backward, but history has proven otherwise. The atomic theory proved useful because it's hypothetical construct, the atom could be linked to directly observable phenomenon. In other words, it was a testable theory. In a theory of language as an interaction which takes place only in the brain, we must first identify the elementary particle, the interaction, and then relate it to observable phenomenon so that it becomes testable.

The interactive atom in this new language theory I am calling a sens-it cell. It can be perceived both as a static structure and as a dynamic mechanism. It might be seen as a kind of electric motor/generator which transforms electric energy to kinetic energy, and vice versa. The sens-it cell transforms signals to meaning and meaning to signals in our heads. It is this interaction that defines language, not the interaction between people. Any language interaction between people, is seen only as a demonstration, an indication that language does indeed already exist in the brains of the participants.

Language as an interactive sens-it cell

The sens-it cell model is presented as one possible model of a new theory in which language is seen as an interactive process which takes place in the head. It was originally "invented" in the process of developing a language course in Russian.[13] And it has since been expanded and refined for over 10 years.[14] It is presented here only in a simplified explanatory fashion for reasons which will become clear later. The name and the conceptual framework of the sens-it cell model were originally derived from the SEN:SIT concept first formulated by I.A. Richards, and the principle of SELection inherent in a hypothesis testing theory of learning. The combination of a signal with a meaning, was treated by Richards in the following way, when he expressed his views about language and language teaching.

1. We learn a new sentence or sentence element by seeing how it applies in a situation.
2. We teach by so presenting the sentence and the situation together that this is seen.
3. In what follows, the abbreviation SEN-SIT will be used for this unit made up of a sentence in the situation which gives it meaning.
4. Teaching a language effectively consists of inventing, arranging, presenting, and testing SEN-SIT s.[15]

To illustrate this phenomenon, consider Helen Keller again. Her teacher put one hand under the flowing water, so that she could experience the SITuation clearly. With her other hand, she moved her fingers into the arbitrary positions, which spelled out the SENtence. The magical moment, when Helen Keller was able to connect, associate and relate this SENtence with that SITuation, was the beginning of her experience with language and the beginning of a whole new life for her.

I have taken this SEN-SIT concept, and attempted to expand on it. I first added the concept of SELection or the interactive structural mechanism between the SENtence and the SITuation. Then I modified the expression, SEN:SIT::SEL to Sens-it Cell to reflect the cybernetic feedback mechanism of all interactive structures. These additions and modifications will be explained in much more detail as we come to them. I will elaborate on each of the terms and how they relate to phenomenon we are all familiar with. But first a note on notation.

Since I am referring to language as an internal phenomenon, rather than an external one, and Richards was referring primarily to the external aspects of that phenomenon, I have preserved the capitalized SEN-SIT abbreviation to refer to the external observable phenomenon, but designated the internal phenomenon as sen:sit, in small letter. This small letter expression, sen:sit thus refers to the basic internal relationship we classify as symbolic thought. The sit:uation is the concept while the sen:tence is the inter-

nal labelling system. The terms are being used in the generic sense, not in a specific sense, thus a SENtence could refer to a syllable such as the plural s at the end of a word, or it could refer to a word or a clause or a sentence or even a paragraph. A sen:sit can be considered a symbol, a relationship of form and meaning within the head at many levels of abstraction.

Symbolic relationships do not imply a simple fusion of a sen:tence and a sit:uation, but rather an interactive process between a system of sen:tences and a system of sit:uations. This interactive process I have designated as a sel:ection process. The sel:ective mechanism can operate in either direction, just as an electric motor/generator can operate in either direction, depending on the source of energy. In the brain a receptive process such as listening or reading would have a SEN:tence input trigger a sel:ection among possible alternative sit:uations. An expressive process such as speaking or writing would have a sit:uation trigger a sel:ection from among a number of possible alternative SEN:tences. The sel:ection process is considered to be handled by the same basic structural mechanism, only the direction is different. It will be noted in more detail later that the "direction" is only an overall phenomenon. Language is considered interactive and therefore all processes proceed in both directions. For example, in the "receptive" process, the sit:uation provides information which helps in an "anticipatory" manner. In the "expressive" process, sen:tence coding rules monitor the output in a "receptive" manner. All processes are considered a mix of top down, bottom up. It should be noted that in both cases, receptive and expressive the SENtence is the publicly observable data that many people in the past have referred to as the "language", but which is being seen in the sens-it cell approach as simply an indicator, a publicly observable manifestation of the language.

A conversation, a "language" interaction between people involves both the publicly observable SENtence and the non-observable sel:ection and sit:uation portions in the Sens-it Cell view of language. Most people, and many linguists have tended to associate language with what I refer to as

the SENtence, and have tended to ignore or take for granted the internal processes. These people tend to separate the concept of language and meaning. Many linguists in fact have attempted to study "grammar" as language independent of meaning. They often claim that this is a "scientific" approach to language. The position taken in this paper is that public data such as the SENtence may be a necessary condition but it is not a sufficient condition for defining language, and that the past public and professional focus on this aspect of language performance has tended to divert attention from a more profitable investigation of the language phenomenon which takes place exclusively in the human brain.

Our over emphasis on language in a communication process has I believe warped our thinking about language as a phenomenon. Our almost exclusive use of the SENtence to communicate our scientific thoughts about "language" has I believe been part of the reason language study has not become more scientific in the past.

Becoming more scientific[16]

One or two people cannot develop a science or technology; they must communicate what they have thought and discovered, and what they have done to other people or it will become lost, forgotten and ignored. But in order for knowledge to be perserved so that it can contribute to a growing accumulation of knowledge, it must be repeatable, reliably repeatable. Historically, two of man's most important media of communications were words and pictures. But these differed for many centuries in their degree of repeatability. Once a word is adopted by a culture, taught and learned in that culture, it can be spoken or written with many variations of vocal sound or graphic design and still represent the same word or verbal symbol. Even though there are some subjective shades of meaning which vary for each individual, the abstract and arbitrary nature of word meanings, tends to make them reliably repeatable, even though their visual or auditory forms

vary somewhat.

On the other hand, a picture which is copied by hand is not reliably repeatable; each time it becomes a different picture. The visual graphic is a direct analog of an individual's visual imagery. It tends to be much more concrete, more representational and less arbitrary than words. The transfer of thought through visuals thus becomes modified by inexact reproduction. Each reproduction of a visual graphic by hand reproduction means, tends to modify, alter and reduce the fidelity of the original. It communicates its information content less and less reliably with each new rendering, with each new repetition. Words on the other hand, being arbitrary symbols standing for abstracted references, tend to be more reliably repeatable through many sayings or writings, and thus tend to convey the same information through each repetition.

The ancient Greeks, whose systems of thought are still revered today, particularly within the educational institutions, could repeat their verbal statements by hand copying, but they had no technology for exactly repeating pictorial statements. Consequently, their intellectual activities were structured mainly along verbal lines. The Greeks were full of all sorts of ideas about all sorts of things, but they rarely checked their thoughts by experimentation or communicated them by pictorial means. Therefore, the only sciences in which the Greeks made significant advances were geometry and astronomy. For the first, words and repeatable line drawings served to store and communicate meaning, and for the second, the stars on a clear night served as a set of repeatable visual patterns for everyone. Other sciences were not advanced by the Greeks. There were certain botanists who wrote descriptions of plants and then illustrated them with realistic drawings, but the drawings suffered so much at the hands of copyists that the Greeks finally gave up even trying to describe the plants and simply listed all the various names by which each plant was known in different locations and told what ailments each was good for.

The development of printing pictures in the fifteenth century heralded

the downfall of the tyranny of words in man's systems of knowledge. Modern science and technology gradually took shape as their indispensable pictorial components were cut or engraved or etched on printing surfaces for widespread dissemination. The linear time order in which words must be used, led naturally to a verbal breaking down of real things into their definable qualities which had only conceptual existence. The reliably repeatable pictures which became available only 500 years ago, allowed the real objects and mental mappings to be presented as a unity, as a gestalt. The availability and use of reliably repeatable visuals has had enormous effects upon mankind. Without them, science and technology as we know them today could not exist. With them, we have created a world in which communications technologies can now let people "see" men landing on the moon and "see" the insides of a human body.

The effects of reliably repeatable visuals upon public education in general and language teaching in particular have been far less dramatic. The educational profession and professional linguists, like the ancient Greeks, seems to be heavily dependent upon a repeatable verbal coding system for the majority of their communications efforts. The occasional and ancillary use of reliably repeatable visuals are referred to as "visual aids" as if they are of secondary value.

Linguistics while attempting to become a scientific discipline still uses the SENtence almost exclusively in attempting to communicate information about "language".[17] This practice restricts the ability of linguists to talk about "language" as anything more than SENtences. Indeed the practice of "reading papers" about language studies at national and international conferences is far more "prestigious" than visual demonstrations which are often referred to in derogatory terms as "show and tell" sessions. Video productions are not considered as "academic" as research "papers".

Education remains a craft and an art with teachers teaching the way they were taught and scientific evidence being utilized only when it supports and legitimatizes existing practices. Linguistics can not integrate meaning

into their definition of language as long as they restrict themselves to the SENtence as a means of communications. Education can not and will not move out of the craft or art stage until it adopts the use of reliable visualization as an integral part of its operations.

The foreign language teaching profession could help the linguists to a fuller understanding of the language phenomenon and it could lead education out of the craft and art stage by adopting some of the new AVC technology which inherently combines the verbal audio component with the reliably repeatable visualization possible with the video disk. By adopting the position that language is a phenomenon which combines verbal audio signals with visualized meaningfulness through an internal interactive mechanism, the foreign language profession could lead the rest of the teaching profession away from an over reliance on the verbal means of communication in educational settings and help it become a more scientifically based and technologically oriented profession.

This is not an easy position to take. As human beings we all share a fundamental limitation in our ability to communicate our thoughts. Most of us have the ability to communcate with SENtences. It is readily available to all of us. Most of us use SENtences every day, and seldom consider the limitations. Unfortunately there is an inherent limitation in what I can "say" about the sens-it cell in this paper. I am using only the SENtence to express it, and I am painfully aware of the limitations of this means of communications. The meanings of the words I use depend upon the readers experiences to a far greater extent than most people realize. How much my words interact with your experiences determines how much meaning is regenerated. How closely your sens-it cell resembles mine determines how similar your perceived meaning will be to the meaning I intended.

The SENtence is a one dimensional digital coding system which contains very little information itself. As was pointed out with a TV system of communications, the SENtence is similar to the electromagnetic wave pattern sent from camera to receiver. The SENtence or signal part of lan-

guage is a phenomenon which would be completely ignored if we were not tuned into it. We are however, so completely used to it, like fish in water, that we do not recognize it as an internal process which we are projecting onto the world "out there". The converter is what makes language meaningful. When we walk down the street of an international city and we hear people speaking languages we have not learned, we don't hear a language, we hear the SENtence of that language. For us, it is a noise which we can very easily tune away from and ignore, just as we can tune out and ignore the thousand of other information signals which are around us. A walk through the woods with a real outdoorsman can very quickly demonstrate the different "tuning" systems. The woodsman will see, hear and smell 2, 3 maybe 10 times as much as the novice. Radio waves are all around us. We certainly don't call them radio. Radio is the converter. Television is the receiver. Language is the sens-it cell inside all of us.

This sens-it cell is the amplifying system which takes one dimensional speech signals and converts or regenerates them into multidimensional meaning in our brain. It also reduces the vast information contained in our own multidimensional meaningful concepts into a stream of one dimensional speech sounds. In addition it "fills in" parts of the signal which may be lost or distorted.

I have proposed that language be consider as an internal phenomenon. I propose however to externalize that phenomenon, by attempting to create a sufficiently detailed mapping between the three basic elements I have identified, the sen:tence, the sit:uation and the sel:ection, with external representation of these internal phenomenon. These will be referred to as a SENtence, a SITuation and a SELection process. The SENtence and SITuation are relatively straightforward. Much of the work of I.A. Richards deals with these two aspects of language and in dealing with them, he communicates with the appropriate means of communications. He uses pictures to help identify SITuations more precisely.[18]

The best demonstration of the Sens-it Cell definition of language would

also require a combination of an auditory SENtence and a pictorial SITuation along with the appropriate SELection process. A few preliminary examples of how this can be done have been incorporated into the *Sony Action English* Video series,[19] and the IBM "Here Comes . . . . " series,[20] but the best demonstration which would include much more of the interactive SELection process will probably require an interactive video disk system. I look forward to the opportunity to demonstrate the full explanatory and teaching power of the Sens-it cell approach on an interactive video disk system some day soon. Until then, I can present some of the ideas through the limited media of the SENtence.

Sel:ection mechanism as an Analog/Digital Converter[21]

One way to look at the sens-it cell is as an analog/digital convertion mechanism. The senses take in information (SITuation) basically in the analog code as perceptions, but the SENtences are coded in the digital code based upon concepts. The right hemisphere processes analog codes much better, while the left hemisphere processes digital codes more efficiently. This is why neurologist have tended in the past to associate language (SENtence) with the left hemisphere. The sens-it cell approach would indicate that all of the brain is involved in language, and this is becoming more and more apparent.

Because these terms are not generally used in language teaching circles, some explanation seems necessary. *Analog* codes are those in which some physical aspect of the signal resembles the thing it represents. The code bears a similarity to the referent. The elements are (a) continuous and (b) natural. *Digital* codes are those in which the thing represented is broken up into discrete units and transmitted over time. The elements are (a) discrete and (b) arbitrary. Information can be transmitted in either code. A key in a lock uses an analog code, while a combination lock uses a digital code. Watches used to be analog with hands moving around the face resem-

bling the movement of time, but recently, digital watches which present discrete numbers one at a time, have become more popular. The codes are processed differently. Analog codes are measured, which means they must be related to a template, or some other feature. Digital codes are primarily counted.

Visuals are a common analog representation. A portrait looks like the person portrayed. There is a "natural" relationship. A speedometer on a car is also an analog device which measures the speed of the car and displays it on a dial. There is a "natural" relationship, as the car goes faster or slower, the dial moves to display that information directly. Our sensory experiences are primarily of an analog nature. Imagining, such as mentally rehearsing one's golf stroke or bowling swing are "thinking" in an analog process.

Words on the other hand, tend to be more digital in nature. The letter A is distinctly and arbitrarily different from the letter B and neither resembles any object in the real world. The word "ape" does not resemble the active, furry creature we apply the label to. In addition, the sequential arrangement of digital coding is critical. The following three letters, for example, denote different meanings, depending upon their sequential arrangement: ATE-EAT-TEA. In the following sentences, the sequence of words is critical to the correct understanding of the sentence: "The dog bites the man" and "The man bites the dog." Logic is our technique of "thinking in sequence". Grammar or syntax are our rules of sequential arrangement of the digital units of speech and writing.

The analog-digital conversion process is basically between an analog SITuation and a digital SENtence. It can go both ways, but the critical point is the recognition that a great deal of information is lost going from analog to digital, and this information must be regenerated when it goes the other way.

To understand the importance of the analog-to-digital conversion, and to appreciate its significance for the distinction between the SITuation and the SENtence (or the perceptual and cognitive processes), consider the

following mechanism.[22] Consider an automobile which can go 100 miles an hour. The speedometer is a direct representation of that. The pointer moves directly to each of the points and even in between to match the movement of the tire on the road. This one hundred unit measuring system provides 6.65 bits of information.

If we attach a converter to this, to signal speed changes through an audio device, we might break it into 4 segments. The converter will signal one low pitched tone, for speeds less than 14, another for speeds from 15 to 24, another tone of still higher pitch for 25 to 50 and a final high pitched tone for speeds above 50. These different ranges may be thought of as the approximate ranges in which one should be in first, second, third, and fourth gear. The converter could be considered as a device for alerting novice drivers of the need to shift gears. The tones are digitally coded. If the driver is going 43 miles an hour, he hears a tone which is the same from 25 to 50. This tone carries 2 bits of information about the speed of the vehicle (a reduction of 100 equally likely possibilities to 4). The output of this analog-digital convertion process is always less, quantitatively, than the input. Although 6.65 bits of information gets in, something less than this comes out. What is gained in this loss of information is "stabilization" of information.

If we were in a racing car, and we had to change speeds constantly and had to shift gears constantly, we would not particularly want to know all the time about the "actual" speed, but rather we would want to know those particular points at which to change gears. The information in the "tones" would be satisfactory. When we move around the room, we don't need to know all of the perceptual changes that take place, only certain critical ones. Thus we stabilize our world through a *classification* process and a *projection* process. Korzybski warns us about the projection phenomenon with his famous "the map is not the territory" dictum,[23] while Whorf points out that SENtences from different cultures may classify the same SITuation differently.[24]

It is this "classification" process, that the Whorfian hypothesis is all about. The way our SENtences "classify" our SITuations help form the way we "project" our perceptions onto the world. For example, for the exact same SITuation, an American would say, "He caught a fish" while a Japanese would say, "Sakana ga kakatteru" (a fish was caught). A Japanese and an American would "see" a slightly different SITuation because of the way each language "classifies" the SITuation.[25]

Continuing with our analogy, it would be as if another car had a different type of engine, and so it shifted five times within the following ranges: 1-10, 11-25, 25-40, 41-60, 61-100. To drive this car, one needs to learn the five gear shifts, the five tones and the shift points. While reality is still the same, and the same 100 points are the same, one's use of gears is somewhat different, and one's sense of speed is also somewhat different particularly if one pays more attention to the audio tones than to other indicators of speed. The Whorfian hypothesis indicates that our particular langauge structure and classification system "biases" our view of reality. Korzybski points out that we then confuse our "projection" of reality with "reality". Our sens-it model helps identify how this might take place. If one pays more attention to the tone system (SENtence), than to the other indicators of "speed" (SITuation), then the Whorfian and Korzybskian hypotheses would probably have more effect than the other way around. Von Foerster points out how this SENtence oriented approach affects our educational products.

> We seem to be brought up in a world seen through descriptions by others rather than through our own perceptions. This has the consequence that instead of using language as a tool with which to express our thoughts and experiences, we accept language as a tool that determines our thought and experience.[26]

We can use the analog to digital illustration just given to help understand the digital to analog process as well. That is, we can use this analogy

to help us understand the language comprehension problem. In order to convert the reduced audio tone information to the more informative speedometer reading in the mind of the driver, consider the following. Some information about the speed of the car can be considered to be directly in the tone itself. For example, we can say that if the driver hears the second tone, then he knows that he is somewhere between 15 and 24 miles per hour. The sequence of the signal tells the driver something also. For example, if the second tone comes after the low tone, then the driver can infer he is closer to 15 than to 24, whereas if the second tone comes after the higher tone which signals 25 to 50, then the better inference would be that he is closer to 24 than to 15. Timing is also a factor. If it is right after a change, then he can figure he is closer to the change point. If on the other hand the tone has a wide range, and/or he remains in that range for a period of time, then there are other factors to consider. For example, if the tone for 25 to 50 miles per hour remains steady for a period of time, the driver might infer his general speed from other factors such as wind flow, rapidity of trees passing by, etc. The tone would give him a general range, but his own experience would help refine this to a much closer point. Broad range tones like this are similar to broad range generalizations like "love" "hate" "militarism" "patriotism" "terrorism" and all the other isms which need reality checks more often.

When a person tries to listen to the tones and figure out what speed he is at, we might say that he is going from digital to analog, or in terms of language, from SENtence to SITuation, or in terms of processing from bottom up. Another approach is for the driver to first "guess" his speed, and then use the tone system to "check" his guess. For example, a driver might guess that he is going 40 to 60 miles per hour, then "tune in" to the tone, in order to determine if he is above or below the 50 mile per hour mark. This anticipatory input is often referred to by psycholinguists as an analysis by synthesis, or top down approach. The sens-it model would point out that this is an interactive process and both activities take place

to one degree or another.

When SENtences are looked at as something separate and independent of "meaning", as was true of much of the earlier analyses of language, then much of this "conversion" process is also lost. In our daily lives, we tend to use our "knowledge of the world" to regenerate the SENtences back into a more complete and full fleshed sit:uation.

Can you imagine a visitor from outer space trying to figure out our TV just from analyzing the electromagnetic waves being beamed through the air. How much could he learn from that alone? What could he know about our language from only paying attention to the sound patterns that go through the air between people? How much can we "know" about "language" if we consider it only or even primarily as those signals that pass between people, those that are publicly observable?

One of the problems of dealing primarily with the "observable" part of language, has been the way the language has been analyzed and classified and utilized for teaching exercises. Students have often been drilled in one particular structure or pattern with substitution exercises like the following:

1.		He ate an apple.
2.	orange	He ate an orange.
3.	dropped	He dropped an orange.
4.	ball	He dropped a ball.
5.	bought	He bought a ball.
6.	car	He bought a car.

Later the student will be drilled in another "structure" like the following:

1.		He gave her an apple.
2.	orange	He gave her an orange.
3.	bought	He bought her an orange.
4.	car	He bought her a car.
5.	himself	He bought himself a car.

The structuralist position would have one see a Subject + Verb + Object arrangement (S+V+O) and a Subject + Verb + Indirect Object + Direct Object (S+V+ID+DO) as separate structures. This means one would classify the following two sentences as "different".

1.	"He bought a car."	Subject + Verb (transitive) + Object
2.	"He bought himself a car."	Subject + Verb + Indirect Object + Direct Object

Native speakers, who have developed similar sens-it cells, would upon hearing the SENtence, "He bought a car" implicitly "regenerate" the fuller SITuation including the "recipient" of the transaction which is made explicitly in the second parallel SENtence, "He bought himself a car." A native speaker would also implicitly regenerate a second actor in the SITuation, the seller of the car, which might have been expressed by a SENtence, "He bought a car from Bill". In addition this same SITuation inherently regenerates a transfer of money or "value" from one actor to another, which could be explicated as, "He bought a car for $1000." All of these "meanings" are implicit in the SITuational side of the verb "buy".

To separate these sentences on the basis of form or SENtence is about equivalent to treating ice and water as different because one is a solid and the other a liquid. This same type of thinking would have us classify water and mercury as similar because they are both liquids, and ice and iron as similar because they are both solids. In language we have these "strange" surface similarities identified constantly. For example:

1. "He bought this car." is considered the same S+V+O structure as
3. "He likes this car." while
2. "He bought himself a car." is considered the same S+V+ID+DO structure
4. as "He asked him a question."

A semantic or SITuational approach to these sentences would however

reveal vastly different internal sem-it cells or atomic structures. It is believed therefore that excess attention to the readily observable SENtences, has greatly warped our understanding of the phenomenon of language as an interactive process which takes place inside the brain and which involves the "regenerative" semantic rules which are implicit at all levels of language analysis. Indeed, many sentences are difficult if not impossible to understand without this "knowledge of the world". Consider for example: "I am going to the store for mother". This has at least two meanings which could only be resolved by knowing where "mother" was located. The sem-it cell approach says that this "knowledge of the world" is an integral part of the language process, all of which takes place in the human brain.

The speedometer illustration presented a one step conversion between information in the analog code and information in the digital code. We will now expand that to a multi-step hierarchial model of analog to digital conversion, or SITuation to SENtence conversion.

Sel:ection as an interactive hierarchial stepladder mechanism

The sel:ection system is seen basically as an analog/digital conversion system in which SITuations are converted to SENtences, and SENtences are converted to SITuations, or at least sit:uations through an interactive hierarchial stepladder process. The interactive process is through feedback loops which control the flow of information through the system. There are three basic references or models for this type of system. The first was the original seminal paper on feedback in behavioral systems by Rosenblueth, Wiener & Bigelow in 1943.[27] The second is known as the TOTE model. This was originally formulated in 1960 by Miller, Galanter & Pribram.[28] The third is a more complete and more generalized model by Powers in 1974.[29]

The first paper, introduces the concept of feedback as a controlling mechanism in interactive behavioral systems. The second model applies this

idea to purposeful human behavior and establishes the hierarchial step ladder concept. The third generalizes the two concepts to apply to all human behavior and hypothesizes a hierarchy of control systems of 9 levels, ranging from stimulus intensity control to control of system concepts. Powers subsumes the TOTE model as a basic control system at the seventh level of his hierarchy. The Sens-it Cell model of language parallels Power's model, and hypothesizes six levels which fall roughly in the middle of Power's model.

From SEN:SIT::SEL to Sens-it Cell

The name and conceptual framework of the Sens-it Cell model was derived from the SEN:SIT concept first formulated by I.A. Richards, and the principle of SELection which comes from cognitive psychology's hypothesis testing theory of learning. The SEN:SIT::SEL formulation was however changed to Sens-it Cell to reflect the influence of cybernetic feedback control theory which underlies the model as well. In feedback theory, the basic idea of "sensing" comes into central focus replacing behavior as the central theme of learning. This next section will review the principle of feedback and how it is an intergral part of the Sens-it Cell model.

The usual example of feedback control given is the thermostat. If the temperature in a room goes down below a certain point, the thermostat "senses" this fact, and automatically sends a message to the heating device to start. When the temperature goes above a certain point, then the reverse action takes place. A servomechanism is a more complicated device which is also used as a feedback control mechanism. A common use is as a "cruise control" or speed regulating device in an automobile. While these devices are very common in engineering, it has only been recently recognized that this is the fundamental control mechanism of human behavior.[30] This recognition began less than 50 years ago.

A group of scientists[31] began the process by developing a new tax-

onomy of behavior which first distinguished between *active* and *passive* behaviors. They defined passive behavior as that behavior which is caused by an energy or a force from outside the system. For example, a billiard ball will remain at rest until an outside force causes it to move, and then it will follow a certain trajectory. The energy came from outside the ball, and it follows the laws of motion as set out by Newton. Active behaviors on the other hand, were defined as those in which the system in motion is also the source of energy. They gave as an example, a homing torpedo which has its own energy supply. These objects exhibit active behavior. Within this definition, almost all animal and human behavior would be considered active behavior. An exception might be for example, the behavior of a boxer hit in the ring and falling to the floor. This would be passive behavior and follow the laws of physics. Physics, in fact, could be considered as the study of passive behavior.

Active behavior, which all humans exhibit, was then divided into two sub-categories: *random* and *purposeful*. A drunk walking around and bumping into a lamp post is often described as exhibiting random behavior. This is because there is no way to predict its sequence. Purposeful behavior is predictable behavior. Purposeful behavior was further subdivided into two more categories: *open-looped or programmed behavior* and *closed loop, or feedback behavior*. Active purposeful programmed behavior is that behavior in which both the energy and the information are internal to the system. Clockworks were the first major mechanical devices to exhibit this type of behavior. Mechanical toys which are designed to exhibit a certain set of behaviors, such as toy dogs which walk and bark are in this category. They are energized by electric batteries and are controlled by internal mechanical devices.

Humans often seem to exhibit programmed behavior, but most human behavior is actually closed-loop feedback controlled behavior. It is therefore this type of behavior which needs to be understood more fully. When a cat chases a mouse, he does not just set a "program" in motion, because the

mouse would use evasive tactics and get away. In other words, where the environment changes, or where the environment "could" change, the behavior must be changed to respond to any changes in the environment. When the cat chases the mouse, and the mouse changes directions, the cat must "sense" this change and change direction himself. In watching a cat and a mouse normally, the action is so rapid that we don't normally notice this continuing sensing, changing, sensing, changing interactive process. We use this closed loop feedback control model to simply walk down a street or pick up an egg. The next time you pick up an egg, ask yourself, how do you know how much to squeeze it, in order to pick it up without breaking it.

In a process as fast as a cat chasing a mouse, the feedback loop may be too slow. The process may require internal "predictions" about the future movements of the mouse. About fifty years ago, these first scientists indicated that there were probably first, 2nd and 3rd orders of prediction. In 1960 another group of scientists pursued this concept of higher order feedback looping. They suggested a hierarchial model of behavioral control which they called a TOTE model.[32] The TOTE stands for Test, Operate, Test, Exit. The Tests are the feedback sensors. The model was presented to the field of psychology, and caused great consternation to the many behaviorists in the field.

To illustrate how the TOTE model worked, they illustrated the process with the hammering of a nail. When hammering a nail, the first thing one does is "test" whether it is flush or not. If it is not, then you "operate" by hitting the nail with a hammer. Then you "test" again. When it "tests" flush, they you "exit" or go to the next nail. Now the model as presented is relatively simple. What made it extremely powerful was the recognition that it was hierarchial in nature, and that in each Operate unit, there was embedded another TOTE. For example, if the nail is not flush, and the "Operate" is to hammer, then one must automatically go into another internal TOTE. This one says, "Test" if the hammer is up. If it is not, then

"Operate" by raising the hammer. But even within this "Operate", one must "Test" for which muscle is relaxed or tensed.

The analysis of the TOTE model can be extended in the other direction as well. Even before one considers the considers the "Operation" of hammering a specific nail, one must "Test" to see if it is in the right place. Before this, one must "Test" whether one wants to use nails or screws. The number of levels at which the TOTE model appear applicable is quite significant, but the more important feature is the concept of time scales. The time required to TOTE the muscle flexing is faster than the TOTE for raising or lowering the hammer, which is faster than the TOTE for hammering in the nail, which is faster than the TOTE for placing the nail in the right place. In other words, the higher in hierarchy one looks at behavior, the longer becomes the time required to perform. Also, because higher levels are "dependent" upon lower levels, the slower the lower levels, the slower the higher levels will be. Skill is the increasing of reaction time . . . at all levels, even though it is only tested at one level.

Powers generalized the feedback control problem, and made it the central theme for all behavior.[33] His position is that perception is what is "learned" and this then acts as the "Test" or sensor and in effect then controls behavior. Prior studies have tended to focus on the role of Stimulus in evoking some Response or behavior. This is the basic S-R model in psychology. Powers points out that "What an organ senses affects what it does, *and what it does affects what it senses.*"[34] He then points out that most behavior is in order to "sense" what one wishes to sense. In other words, we behave in order to control our perceptions, rather than let our perceptions control our behaviors. To understand this better, consider the following.

Traditional psychology saw the "results" of a behavior of a subject from their point if view, from what they wanted to sense, but they ignored the motor acts themselves, and the perceptions "from the point of view of the subject." When a pigeon is trained to walk in a figure eight pattern,

there are at least two ways in which it can be viewed. The first is what the behaviorists . . . and teachers tend to observe – the results, the pattern intended as observed in the perceptual organs of the experimenter . . . or teacher. But the behavior itself consists of muscular movements themselves. The figure eight is created by walking movements. The act of walking produces the result of a figure eight pattern in the observers perception. The observer sees this as consistent behavior that remains the same over several trials after the bird has learned the pattern. But the observer fails to notice that the movements are always different. As the pigeon traces out the figure eight over and over, its feet are placed differently on each repeat of the same point of the pattern. Variable acts produce a constant result.[36]

The results in what the experimental observer sees – and the results – in the mind of the performer, are the causal factor in the movements which create it, according to Power's model. The acts of the performer will vary each time in order to create not "a consistent behavioral act", but a constant perceptual result "in the mind of the performer". The purpose of behavioral acts are in cybernetic feedback terms, to produce the perceptual results that are in fact observed. The behavioral experimenter . . . or a teacher can not and does not teach a behavioral act. The only thing that can be learned is a perceptual result "on the part of the performer". This perceptual result, then acts as a "Test", or sensing device which in turn controls the "Operate" behavioral act. The implications of this viewpoint are reflected in the Sens-it Cell model approach to teaching.

The successful behavioral act is merely an indicator that the perceptual results desired, have been successfully learned. From a cybernetic feedback point of view, the teacher or experimenter can never directly control the behavior of another. Each individual always controls his own behavioral acts. The only thing which can be learned is competence, which is not directly observable. Appropriate performance is always just an indicator that the competence (perceptual guidance system) has been internally developed since performance is always internally generated. As Smith and Smith

put it, "Cybernetic theory views the individual as a feedback system which generates its own activity in order to detect and control specific stimulus characteristics of the environment."[36]

In terms of language teaching what this essentially indicates is that one can not teach language as "talk". One can not teach language as anything but competence. On the other hand, the primary competence may well be seen as "receptive" competence, that is the ability to properly perceive. Once that perception is fine tuned, then it will control any behavioral response the student wishes to make, when the student wishes to make it. Building linguistic competence is then a building of the perceptual guidance systems in the hierarchial sens-it cell. It is the establishment of the TOTE "tests" at all levels of the hierarchy.

The Sens-it Cell approach to teaching thus sees the comprehension, receptive or listening approach as the most profitable from a learning efficiency point of view. This is partly because of the automatic transfer from receptive competence to expressive competence which is inherent in cybernetic feedback theory. But it is also because the SENtence is seen as the most difficult portion to be internalized. In the Sens-it Cell approach, both the SENtence and the SITuation are seen as critical, and both must be internalized and integrated in an internal sel:ection interaction process. But as Piaget pointed out, one never comes to a new environment as a blank slate, one always has some structure already. The new SITuation is probably very much like the old sit:uation already internalized and part of memory. On the other hand the new SENtence does not have a very strong sen:tence base in the beginning of language learning. It therefore would appear to require many more receptive repetitions before it became a firmly embedded sen:tence in the learner's auditory memory bank. People with good natural auditory memories may pick up the SENtence more quickly . . . these are the people who learned with the audio-lingual methodology. But those with poorer auditory memories may require more repetitions, but they will as individuals know when they have had enough. That's when they

will start expressing themselves. Forcing speech too soon however requires the speaker to refer back to the sen:tence which is in memory . . . the old established "sen:tence" rather the newly forming one. This is the basic cause of accents, grammatical oddities, strange phrasings, etc. in people forced to speak before they have fully internalized the new language. Language seen as a sens-it cell is a complex analog/digital conversion hierarchy which will grow naturally if properly nurished, but will like a bonsai tree become warped if forced prematurely.

Details of this hierarchial Sens-it Cell are not possible within this paper. Another paper is being planned to provide more details, and eventually an interactive video disk system will provide the best demonstration. In the meantime, I will present a simplified, SENtence oriented version, to at least provide a general framework for understanding the potential of this approach. For the hierarchial SELection system, which will look strangely close to a traditional "Grammar" approach, we will look only at six major levels of sens-it cell interaction processes, going from the analog end to the digital end, from the multidimensional meaningful level to the one dimensional signal level. These are of course, preliminary hypothetical levels, which when more completely elaborated should be able to generate testable hypotheses.

The six levels of interactions are

1. The discourse-plans level which deals with both the SENtence oriented discourse analysis results and the SITuationally related purposeful plans concepts inherent in the TOTE model, and suggested by Shank in his *conceptual dependency theory*.[37] Familiar SENtence subunits are:

   A. Suasive Discourse (Causing action on the part of others.)
   B. Descriptive Discourse (Identifying and describing static scenes.)
   C. Narrative Discourse (Describing temporal actions and events.)
   D. Conversational Discourse (Verbal exchange between people.)

2. The clausal-script level which deals with both the SENtence oriented concepts of sentence types and the SITuationally oriented generalized epi-

sodes we call up from memory. Not so familiar SENtence subunits are:

A. Action Sentence Structures.

These refer to dynamic material or mental actions, which involve either a single actor generating his own actions such as "He was walking" or an actor acting upon some object, such as "The man put the book on the shelf". Careful SITuational analysis will indicate the implicit as well as the explicit sens-it cell requirements.

B. State Sentence Structures.

These refer to static physical or mental states. In English, most of the static physical states utilizes the copula in such sentences as "The man is a doctor" and "The cat is in the tree" as well as the famous "This is a pen."

C. Causitive Sentences Structures.

Causitive sentence structures are those which identify or describe "changes of state". In this category, are such SENtences as "The man died" or "He painted the house" which superficially look like the old familiar categories of S + V and S + V + O, but which involve quite different sets of sit:uational inferences.

3. The group-conceptualization level which deals with SENtence oriented concepts of nominal groups and verbal groups, and the SITuationally oriented conceptualizations of things and actions.

A. Nominal Group Systems

B. Verbal Group Systems

C. Circumstancial Group Systems

4. The lexical-semantic level which deals with the familiar SENtence oriented "content words" and the SITuationally oriented idea of stable independent semantic knowledge associated with these labels.

A. Nouns-things

B. Verbs-actions-relationship

C. Adjectives-attributes-refinements

D. Adverbs-circumstances-refinements

5. The marker-address level which deals with the SENtence oriented "function words" and "morphemics" and the SITuationally oriented idea of contextual addressing devices.

A. Function Words-case markers-refinement markers

B. Affixes-case markers-refinement markers

6. The Prosody-signal level which deals with the SITuational signal system and the initial SENtence identification markerings such as phomenes, intonation, etc.

The levels were identified on the basis of static structural characteristics and dynamic mechanism characteristics. Static structure is considered that form which remains as the parts change. Thus, a SENtence structure was often considered that form which remained as words were substituted. For example, "The boy hit the ball," "The man told a story" and "The girl liked the ice cream," were all considered by some linguists to be the same structure, that is, a transitive subject-verb-object structure. A dynamic mechanism, is considered to be how a structure changes. Linguists have sometimes used the term transformation to indicate this idea. For example, The sentences: "He told a story to him," and "He told him a story" are transformation according to some linguists, and would indicate one example of what is being referred to here as a dynamic mechanism. However, dynamic mechanism refers primarily however, to the way SITuational changes interact with the SENtence structures to change them in a continually dynamic and interactive flow. As Lenneberg expressed it,

> The basic proposition stressed is that language-knowledge is an activity (not a static storehouse of information), namely, the extraction of peculiar relationships from the environment and the interrelating of these relationships.[38]

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Summary

In order to teach anything, two fundamental questions must be continually asked and answered: (1) What should be taught? and (2) How should it be taught? The answer to the second question is highly dependent upon the answer to the first. This paper has attempted to present an answer to the first which would help clarify the answer to the second.

I look forward to the day when language is more generally recognized as an interactive process which takes place in the human brain. When linguists accept the meaning as an inherent part of the language then they will also be forced to communicate with SITuations as well as SENtences. This should I believe improve our understanding of what language is as a phenomenon. I believe this shift in viewpoint will also create great improvements in the language teaching profession. When people accept the fact that language is an interaction between SENtence and SITuation, then they will learn to teach more effectively by inventing, arranging and presenting audio SENtences together with visual SITuations such that there is a high probability that this SEN:SIT interaction will be internalized. They will also then ensure that the accurate and correct interaction is internalized by continuous testing and provision of immediate knowledge of correct interaction.

I also look forward to the realization by teachers and students that human teachers, live in a classroom, just can not achieve this. The human teacher without external assistance can only provide the SENtence part of language. With some ingenuity and a variety of artifacts, realia and visual props, some teachers have over the years simulated some SITuations. But this has not been all that wide spread, nor has it been very reliable. Educational technology with the capacity to present reliably repeatable visualizations must become an inherent part of any educational system which attempts to teach language as an interactive process in the brain. The most likely candidate on the horizon today, to teach language as a sens-it cell is the interactive video disk system.

Unfortunately, the history of educational innovations, indeed the history of any technological innovation is not encouraging. Teachers tend to teach the way they were taught, and teachers will attempt to program the new AVC systems the same way they taught, through SENtences. This approach is what McLuhan has called the "rear view mirror" approach.[39] He points out that the new technology of movies first used old stage shows as their content, then the new technology of TV used old movies as their first content. Most

of the first AVC programs (interactive video disks) feature "conversations" as their first content thus completely missing the unique advantage inherent in the media.

Nevertheless, with time and a recognition of this new viewpoint of language, I look forward to the use of the new educational technologies to teach foreign languages in all countries in a much more effective and efficient manner. I see for example the use of broadcast television as a start by bringing simple "cartoon" features which are so visually obvious that one can "guess" most of the meaning directly. These would be entertaining features which would be so visually exciting and interesting that one would watch "and listen" even though one might not understand everything at first. I see the use of cable TV in which quizes are integral with the broadcast and in which the audience can test themselves by immediate feedback devices in their homes. These tests would not be "dry language tests", but rather like following a mystery and checking on clues provided. I see the use of interactive video disks with games, entertaining feature films and "creative movie making" as various options for people who want to "get involved in a SITuation" and happen to become involved in its SENtences as well. Once we have a better understanding of WHAT to teach, we will also have a better grasp of HOW to teach it.

Notes

1. *Follow Me* is a video series produced by the BBC and distributed through out the world. One version has been broadcast over Chinese television and several newspaper reports indicate an audience of around 10 million viewers.
2. From *Helen Keller* by Margaret Davidson. New York: Scholastic Book Services, 1969. p. 43.
3. Jean Piaget. *Six Psychological Studies.* New York: Random Press, 1967. p. xii.
4. Based on a discussion of Piaget's epistomological philosophy in Herbert Ginsburg and Sylvia Opper, *Piaget's Theory of Intellectual Development.* Englewood Cliffs, N.J.: Prentice-Hall, Inc. 1969. p. 216-217.
5. Wilga Rivers, "Comprehension and Production: The interactive Duo." Paper presented at AILA Conference, Brussels Aug. 1984.
6. N. Chomsky, "Review of *Verbal Behavior* by B.F. Skinner." *Language* 35, 26-58. 1959.
7. See for example, D.A. Wilkins, *Notational Syllabuses,* Oxford: Oxford University Press. 1976.

8. Steve Krashen, *Second language acquisition and second language learning.* Oxford: Pergamon Press. 1981.
9. N. Chomsky, *Aspects of the Theory of Syntax.* Cambridge, Mass.: MIT Press, 1965, p. 174.
10. J.R. Searle, *Speech Acts.* Cambridge: Cambridge University Press, 1970.
11. V. Postovsky, "On Paradoxes in Foreign Language Teaching." *The Modern Language Journal.* Vol. LIX, No. 152 Jan.-Feb. 1975, p. 19.
12. Eric H. Lenneberg, "Brain Correlates of Language", *The Neurosciences: Second Study Program.* edited by Francis O. Schmitt. New York; The Rockerfeller University Press, 1970. p. 370.
13. Frank Ingram, James Nord & Donald Dragt, "A Program for Listening Comprehension" *Slavic and East European Journal.* Vol. 19 No. 1 Spring 1975. p.1-10. Also, James R. Nord, "Sens-it Cell" *System* Vol. 3 No. 1, Jan 1975. p.16-23.
14. James R. Nord, "Developing Listening Fluency before Speaking: An Alternative Paradigm." *System,* Vol. 8, No. 1, Jan. 1980, pp. 1-22, also "The Sens-it Cell Model" *Kanagawa University Foreign Language Bulletin* Vol. 6, 1983. pp. 57, 69. and "Listening and Speaking: A Cybernetic Synthesis" *Nagoya University of Commerce Bulletin* Vol. 30, No. 1 & 2. Nov. 1985. pp. 697-722. by the same author.
15. "Notes on Principles of Beginning Language Instruction" which was prepared by I.A. Richards for a UNESCO Conference in Paris on June 19, 1947. Found on p. 125 in I.A. Richards, *Design for Escape,* New York: Harvest Book, Harcourt, Brace & World, Inc. 1968.
16. The invention of the printing press has been given great historical significance largely because of Gutenberg's use of moveable type, and the mass production possible of the printed word, particularly the Bible. The other great significance of the printing process, the reliable reproduction of pictures, was just recently point out by W.M. Ivins, Jr. in *Prints and Visual Communications,* London: Routledge and Kegan Paul, 1953. It was also discussed in Karl U. Smith and Margaret Foltz Smith *Cybernetic Principles of Learning and Educational Design,* New York: Holt, Rinehart & Winston, Inc. 1966. In another 100 years, this second significance may be recognized as far more important than the first.
17. A rare exception is Michael Paradise a Professor at McGill University in Montreal who uses a series of pictures in his test for aphasia in bilingual and multilingual patients. He has developed a set of visual SITuations which he has then co-ordinated with SENtences from 32 different "languages". He uses these Sens-it Cells to try to identify the location of brain damage in multilingual patients.
18. I.A. Richards & Christine Gibson *English Through Pictures, French Through*

Pictures and other languages through picture series, published by Washington Square Press, New York.

19. The *Sony Action English* program is a 10 lesson video series at the elementary level written by James R. Nord and produced by Sony Language Laboratory. It incorporates a number of Sens-it Cell examples and principles. It illustrates how the "theory" can be applied to vicarious learning materials in a practical and useful manner.
20. *Here Comes Charlie* and *Here Comes Harold* are two CAI programs written by James R. Nord for IBM Japan. They combine the visual graphic and text capacity of an IBM 5550 computer with a random access audio tape unit. This allows a programming which is highly compatible with the Sens-it Cell principles and demonstrates another "practical" use of this theory.
21. The basic idea of language as Analog/Digital conversion is derived from discussions with professional acquaintances in a variety of disciplines such as artificial intelligence, computer science, engineering, linguistics, neurology and psychology for a period of 20 years or so. It was hinted at by the father of modern computers, John von Neumann in *The computer and the Brain* New Haven & London: Yale University Press, 1958, but it was not extensively pursued until recently. For a recent expansion on this idea, see Fred Dretske, *Knowledge & the Flow of Information* Cambridge, Mass.: MIT Press, 1982.
22. *Ibid.*, Chapter 6.
23. Alfred Korzybski, *Science and Sanity* Lancaster, Pa.: The Science Press Printing Co. 1933, p. 58.
24. See J.B. Carroll, ed. *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*, New York, 1956.
25. Anthony Alfonso. *Japanese Language Patterns* Vol. II Tokyo: Sophia University L.L. Center of Applied Linguistics, 1974. p. 885.
26. Heinz von Foerster. "Perception of the Future and the Future of Perception", *Instructional Science* No. 1, March 1972, p. 34.
27. A. Rosenblueth, N. Wiener, & J. Bigelow. "Behavior, purpose and teleology," *Philosophy of Science*, 1943, 10, pp. 18-24.
28. G. Miller, E. Galanter & K. Pribram, *Plans and the Structure of Behavior*, New York: Holt, Rinehart & Winston, 1960.
29. William T. Powers. *Behavior: the Control of Perception*. Chicago: Aldine Publishing Company, 1973.
30. See for example, J.A. Adams. "A closed loop theory of motor learning" in *Journal of Motor Behavior* Vol. 3(2), 1971; also P.K. Anokhin, "Cybernetics and the Integrative Activity of the Brain" in M. Cole & I. Maltzman (eds.)

A Handbook of Contemporary Soviet Psychology. New York: Basic Books, 1969. The classic is of course, N. Wiener *Cybernetics*. New York: Wiley, 1948.

31. Rosenblueth et. al. *op.cit.*
32. Miller et. al. *op.cit.*
33. Powers, *op.cit.*
34. *Ibid.* p. 41.
35. William T. Powers, "Feedback: Beyond Behaviorism" *Science* Vol. 179, Jan. 1973.
36. Smith & Smith, *op.cit.* p. vii.
37. See Roger C. Schank "The Role of Memory in Language Processing" in *The Structure of Human Memory* ed. by Charles Cofer. San Francisco: W.H. Freeman & Company. 1976.
38. Lenneberg, *op.cit.* p. 370.
39. Marshall McLuhan, *Understanding Media: the extensions of man* New York: Signet Books, 1964.